特願2001-7049

VERIFICATION OF A TRANSLATION

I, the below named translator, hereby declare that:

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That I am knowledgeable in English and Japanese languages and that I believe the following is a true and complete translation into English language of Japanese Patent Laid-Open No. 2002－217942 filed in the Japan Patent Office on January 15, 2001 for Letters Patent. including a true translation of the Official Certificate of the Application.

Signed this 28th day of February, 2007

Yasuharu Nagai
Full Name of Translator


Signature of Translator

No. 10-3-1111
Higashimikuni 3-chome, Yodogawa-ku,
Osaka 532-0002 Japan
Post Office Address

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(71) Applicant: 000006297

Murata Machinery, Ltd.

3, Kicchoin Minami-Ochiai-cho, Minami-ku, Kyoto-shi, Kyoto-fu

(72) Inventor: Tanimoto Yoshifumi
136, Takeda Mukaishiro-cho, Fushimi-ku, Kyoto-shi,
Murata Machinery, Ltd.
Head office plant
(74) Agent: 100101948
Patent Attorney Yanagisawa Masao
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5K030 GA15 HC01 HD03 HD06 KA01 KA05
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(54) [Title of the Invention] Relay Server and Communication System
(57) [Abstract]
[Object] To provide a communication system wherein a connection to terminals within a local system from the Internet or a connection between terminals within different local systems is realized while maintaining the safety of the local system.
[Solving Means] A user ID and a password of each terminal are memorized in advance in a connection information holding unit 42. A terminal 11 is certified by the user ID and the password after connected to a relay server 4, and then, maintains the connection. A terminal 21 is also connected to the relay server 4 in the same manner, and maintains the connection. When a connection request from the terminal 11 to the terminal 21 is sent, the relay server 4 forwards the connection request to the terminal 21, and realizes communication between the terminals. After that, when data is forwarded from the terminal 11 to the relay server 4, the relay server 4 relays the data and transmits the data to the terminal 21. Accordingly, communication can be performed between terminals in different local systems.

[What Is Claimed Is:]

[Claim 1] A relay server comprising:

communicating means capable of communicating with a plurality of network devices; and

connection information holding means for holding connection information of said network devices capable of communicating by said communicating means,

wherein said communicating means carries out communication with said network devices in accordance with said connection information, and relays data forwarding to/from a specified network device in accordance with connection demand information generated from said network device.

[Claim 2] A communication system in which a plurality of network devices and a relay server are connected by a network,

wherein each of said network devices establishes a communication path to said relay server, and generates a connection demand with another network device to said relay server when communicating with another network device, and said relay server relays the communication between said network device and said another network device by using the communication path established in advance in with said another network device in accordance with the connection demand from said network device.

[Claim 3] A communication system according to claim 2, wherein said network devices are devices to which connection from an outside network is limited.

[Claim 4] A communication system according to claim 2, wherein said network devices are connected via a gateway device having an address converting function.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Belongs]

The present invention relates to a communication system wherein a plurality of network devices and relay servers are connected by a network, and the relay servers, which are preferable to be used in such communication system.

[0002]

[Prior Art]

Figure 3 is a view for explaining an example of a system adopting the general Internet. In the figure, the reference numbers 1, 2 are local systems, 3 is the Internet, 11, 12, 21, 22 are terminals, 13, 23 are gateways, and 14, 24 are LAN. The local system 1 is constructed by the terminal 11, the terminal 12, the gateway 13 or the like being connected by the LAN 14. The gateway 13 is connected to the Internet 3 along with the LAN 14, and one can use the Internet from various network device such as the terminal 11, the terminal 12 or the like on the LAN 14. Moreover, the local system 2 is also constructed in the same manner such that it is constructed by the terminal 21, the terminal 22, the gateway 23 or the like being connected by the LAN 24. The gateway 23 is connected to the Internet 3 along with the LAN 24, and one can use the Internet from various network device such as the terminal 21, the terminal 22 or the like on the LAN 24. Needless to say, in each of the local system 1 and the local system 2, other various devices are connected by the LAN 14 and the LAN 24.

[0003] In such system, generally, one global IP address or a plurality of global IP addresses is assigned to the local system

1 and the local system 2 but the global IP address is not necessarily assigned to each network device within the local system 1 and the local system 2. A private IP address is assigned to each network device within each of the local system 1 and the local system 2, and the private IP address is converted into the global IP address by using functions such as NAT or IP masquerade by the gateway 13 and the gateway 23. By using the gateway 13 and the gateway 23 including such IP address converting function, for example in the local system 1, the terminal 11 and the terminal 12 are to use the Internet 3 via the gateway 13. In addition, in the local system 2 the terminal 21 and the terminal 22 are to use the Internet 3 via the gateway 23.

[0004] Moreover, the gateway 13, the gateway 23 or other network devices or the like includes a function such as a fire wall or a proxy server, and a structure, in which terminal uses the Internet 3 via these devices, is used, and the safety in the system is improved.

[0005] For example, when one attempts to access the terminal 11 within the local system 1 from the Internet 3, the global IP address of the gateway 13 can be learned. However, the private IP address of the terminal 11 cannot be learned. Therefore, in the general connecting method, the terminal 11 cannot be accessed from outside of the local system 1. Moreover, there are cases in which by the function of the fire wall of the gateway 13 for example, the site for accepting the access is limited. Further, it is to be the same manner in the terminal 12, and also in the terminal 21 and the terminal 22 within the local system 2.

[0006] Furthermore, the terminal 11 and the terminal 12 within the local system 1, and the terminal 21 and the terminal 22 within the local system 2 are generally provided with only client functions, and are not provided with functions as a server for receiving information from a different network device. Therefore, unless accessing from the terminals 11, 12, 21, 22 to the different network device, information cannot be transmitted to these terminals from the different network device.

[0007]

[Problems to be solved by the Invention] The present invention has been made in consideration to aforementioned circumstance, and the object of the present invention is to provide a communication system in which a connection to terminals within a local system from the Internet or the connection between terminals within different local systems is realized while maintaining the safety of the local system, and a relay server preferable to be used within such communication system.

[0008]

[Means for Solving the Problems] The present invention is a relay server having: communicating means capable of communicating with a plurality of network devices; and connection information holding means for holding connection information of the network devices capable of communicating by the communicating means, in which the communicating means carries out communication with the network devices in accordance with the connection information, and relays data forwarding to/from a specified network device in accordance with connection demand information generated from the network

device. In this manner, the relay server relays data forwarding between the network devices that are connected to the server. Accordingly, the data can be forwarded even in the case where the network device is a terminal within the local system, and the communication can be carried out from the Internet to the terminal within the local system, or between the terminals within different local systems. Moreover, by holding the connection information of the network devices capable of carrying out such relay communication, and by carrying out the communication with the network devices according to the connection information, the connection by the third party can be prevented and the safety of the local system can be maintained.

[0009] Further, the present invention is a communication system where a plurality of network devices and a relay server are connected by a network, in which each of network devices establishes a communication path with the relay server, and generates a connection demand for communication with another network device to the relay server when communicating with the another network device, and the relay server relays the communication between the network device and the another network device by using the communication path established in advance with the another network device in accordance with the connection demand from the network device. For example, even in the case where the network device is a device whose connection from the outer network is limited such as the terminal to which the network device is connected via a gateway device including an address converting function, the data is relayed by the relay server to which these devices are communicably connected, so

that the communication can be carried out between these devices.

[0010]

[Embodiments of the Invention]

Figure 1 is a constitution figure showing an embodiment of a communication system including the relay server of the present invention. In the figure, for the same part as the part of Fig. 3, the same reference number is to be applied and the repetitive description will be abbreviated. The reference number 4 is a relay server, 41 is a communication unit, and 42 is a connection information holding unit. The relay server 4 is connected to the Internet 3, and includes a global IP address. By accepting a log-in demand to the global IP address from the network device, the connection with the network device is to be maintained and the communication path is to be maintained. Such connection is to be maintained with a plurality of network devices. Then, when forwarding the data from a first network device to a second network device, the relay server 4 receives the data by using the communication path between the first network device and the relay server 4, and the relay server 4 further transmits the data by using the communication path between the relay server 4 and the second network device. By relaying the communication between the first network device and the second network device in such a manner, the communication between the first network device and the second network device can be realized.

[0011] For example, although the connection can be made from the relay server 4 to the gateway 13 within the local system 1, it cannot be connected to the terminal 11 or the terminal 12. However, by using the global IP address of the relay server

4, it can be connected to the relay server 4 from the terminal 11 or the telminal 12 via the gateway 13. Therefore, by demanding log-in to the relay server 4 from the terminal 11 or the terminal 12, the communication in both directions can be carried out between the relay server 4 and the terminal 11 or the tetminal 12 which demanded the log-in. In the same manner, although the connection can be made from the relay server 4 to the gateway 23 within the local system 2, it cannot be connected to the terminal 21 or the terminal 22. However, by using the global IP address of the relay server 4, the connection can be made to the relay server 4 via the gateway 23 from the terminal 21 or the termlnal 22. Therefore, by demanding log-in from the terminal 21 or the terminal 22 to the relay server 4, the communication in both directions can be carried out between the relay server 4 and the terminal 21 or the terminal 22, which demanded the log-in. Further, as it has been described by referring to Fig. 3, the communication cannot be carried out directly between the terminal 11 or the terminal 12, and the terminal 21 or the terminal 22.

[0012] For example, when the communication path is established by the terminal 11 within the local system 1 and the terminal 21 within the local system 2 by demanding log-in to the relay server 4, the relay server 4 is capable of carrying out the communication in both directions with the terminal 11, and the communication in both direction with the terminal 21. When the relay server 4 receives a communication demand from the terminal 11 to the terminal 21, the relay server 4 receives the data transmitted from the terminal 11 and transmits the received data to the terminal 21. Thus, the data forwarding from the terminal

11 to the terminal 21 is carried out. On the contrary, the relay server 4 is also capable of receiving the data transmitted from the terminal 21 and then transmitting the received data to the terminal 11. In such a manner, the communication between the terminal 11 and the terminal 21 can be realized.

[0013] The relay server 4 can be constructed by including the communication unit 41 and connection information holding unit 42. The communication unit 41 is capable of communicating with a plurality of network devices via the Internet 3. In addition, when the communication unit 41 receives the connection demand information from the network device which is communicably connected, following the connection demand information, the unit relays the forwarding of the data between the network device which is communicably connected and a network device which demanded the connection. For example, when the terminal 11 and the terminal 21 are communicably connected by the communication unit 41 respectively, and the communication unit 41 receives the connection demand information with the terminal 21 from the terminal 11, the data is forwarded between the terminal 11 and the communication unit 41 and the data is also forwarded between the communication unit 41 and the terminal 21, and as a result, the communication can be carried out substantially between the terminal 11 and the terminal 21. Of course, it is possible to secure a plurality of connections with one network device, and the communication can be carried out with a plurality of network devices by using a plurality of connections.

[0014] The connection information holding unit 42 holds the connection information of the network device which is capable

of communicating by the communication unit 41, and can be used in the certification when the communication unit 41 carries out the communication by being connected to the network device. The connection information includes the user ID and the password, for example, and when receiving the connection demand from the network device, the certification can be carried out by receiving the information of the user ID and the password, and it is determined whether or not the communication can be carried out. Moreover, various setting information or the like in the communication can be included in the connection information. Furthermore, in the case where the unit receives the connection demand information from a communicably connected network device and relays data forwarding to/from another network device, it can hold the relay information as well.

[0015] Fig. 2 is a sequence diagram showing an example of the communication procedure in the embodiment of a communication system including the relay server of the present invention. The communication procedure shown in Fig. 2 is carried out by using TCP/IP, and the connection with the relay server 4, the maintenance of the connection, the connection demand to the terminal, the data forwarding to the terminal, the termination of the connection with the terminal, and the termination of the connection with the terminal or the like is carried out. As an example, it is shown of the case in which the communication is carried out between the terminal 11 within the local system 1 and the telmina1 21 within the local system 2 of Fig. 1. The terminal 11 and the terminal 21 are to be registered as a user to the relay server 4 in advance. As the information of registration, there are the user ID, the password or the like.

These pieces of information are to be held as the connection information by the connection information holding unit 42.

[0016] When the terminal 11, after being activated or directed by an operator for example, the terminal 11 is connected to the relay server 4 via the gateway 13, performs log-in, establishes TCP/IP connection (connection 1) with the relay server 4 in the process (1). Since the terminal 11 is a network device within the local system 1, the communication cannot be carried out directly from the relay server 4, but the connection can be made to the relay server 4 by the log-in from the terminal 11 which is a client. Since TCP/IP connection is capable of data communication in both directions, the communication can be carried out from the tenninal 11 to the relay server 4, or from the relay server 4 to the terminal 11.

[0017] After the connection 1 is established, the terminal 11 transmits the user ID and password to the relay server 4 in the process (2). The relay server 4 checks whether or not the received user ID and the password are held as the connection information in the connection information holding unit 42, and carries out the certification of the terminal 11. By this certification, the connection with an unspecified third party can be prevented, and the safety can also be secured. In the case of failing to make the certification in that the connection information is not registered or that the password is not correct for example, the relay server 4 carries out negative response to the terminal 11, or disconnects the connection 1 as it is. When the certification is succeeded, positive response is carried out in the process (3), and the server controls the connection 1 to be maintained until the connection

1 is disconnected.

[0018] When TCP/IP connection with the relay server 4 is established and the certification is obtained, a command to hold the connection is transmitted to the relay server 4 periodically to maintain the connection (connection 1) in the process (4), and the response of confirmation is obtained from the relay server 4 in the process (5). The connection is to be held accordingly, and it is confirmed that the relay server is operating normally.

[0019] As in the same manner, the terminal 21 makes connection to the relay server 4 via the gateway 23, performs log-in, and establishes TCP/IP connection (connection 2) with the relay server 4 in the process (1'). Since the terminal 21 is also the network device within the local system 2, the communication cannot be carried out directly from the relay server 4, connection can be made to the relay server 4 by the log-in from the terminal 21 which is the client. By the connection 2, the communication can be carried out from the termmal 21 to the relay server 4, or from the relay server 4 to the terminal 21.

[0020] After the connection 2 is established, the terminal 21 transmits the user ID and the password to the relay server 4 in the process (2'). The relay server 4 checks whether or not the received user ID and the password are held as the connection information in the connection information holding unit 42, and carries out the certification of the terminal 21. In the case of failing to make certification in that the connection information is not registered or that the password is not correct for example, the relay server 4 carries out negative response to the terminal 21, or disconnects the connection 2

as it is. When the certification is succeeded, positive response is carried out in the process (3'), and then, the relay server 4 controls the connection 2 to be maintained until the connection 2 is disconnected.

[0021] When TCP/IP connection with the relay server 4 is established and the certification is obtained, the command for holding the connection is transmitted to the relay server 4 periodically to maintain the connection (connection 2), in the process (4'), and the response of confirmation is obtained from the relay server 4 in the process (5'). The connection is to be held accordingly, and it is confirmed that the relay server 4 is operating normally.

[0022] Meanwhile, the connection between the terminal 11 and the relay server 4, and the connection between the terminal 21 and the relay server 4, can be carried out at any time if it is before the communication between the both terminals. Moreover, it is necessary that the connection with the relay server 4 be maintained until the communication between the both terminals starts.

[0023] When a demand is generated in that the connection is to be made from the terminal 11 to the terminal 21, the terminal 11 specifies the user ID of the terminal 21 to demand the connection in the process (6), and demands the connection to the relay server 4. Further, the user ID of the terminal 21, which is to be the connection destination, can be specified by any method such as obtaining in advance or specifying by confirming to a list or the like of the users in the log-in state from the relay server 4. When the terminal 21 corresponding to the specified user ID is not in the log-in state, the relay

server 4 returns the error to the terminal 11. Moreover, when the terminal 21 is under the log-in state, the relay server 4 transmits a connection demand notification including the information that there is a connection demand to the terminal 21, and the user ID of the terminal 11 which is demanding the connection in the process (7).

[0024] The terminal 21 memorizes that the connection used for the transmission of the connection demand notification is used in the connection with the terminal 11, and responds that it is acceptable in the process (8). Further, when rejecting a connection, the terminal 21 sends back an error. The relay server 4 sends back the response from the terminal 21 to the terminal 11 In the process (9). When the response from the terminal 21 is a response of acceptability, the relay server 4 memorizes that the connection 1 and the connection 2 are to be used in the communication between the terminal 11 and the terminal 12 respectively. Moreover, in the terminal 11, which received the response from the terminal 21, when receiving the response of acceptability, the connection in use (connection 1) is memorized as the connection to be used in the communication with the terminal 21.

[0025] After it is confirmed of carrying out the communication between the terminal 11 and the terminal 21 in the manner stated above, the data is to be transmitted actually on and after the process (15). Further, in the example shown in Fig. 2, after it is decided that the communication is to be carried out between the terminal 11 and the terminal 21, a new TCP/IP connection is to be established to the relay server 4 respectively for receiving the connection demand from a different network device

and for carrying out the connection demand to a different network device. In other words, the terminal 11 performs the log-in to the relay server 4 to establish TCP/IP connection (connection 3) with the relay server 4 in the process (10), and the terminal 11 transmits the user ID and the password to the relay server 4 in the process (11). The relay server 4 carries out the certification of the terminal 11 by the received user ID and password, and sends back the response in the process (12). Then, the connection holding command is transmitted from the terminal 11 periodically to the relay server 4 to maintain the connection 3 in the process (13), and the relay server 4 sends back the response to the terminal 11 in the process (14). As in the same manner, the teminal 21 performs the log-in to the relay server 4 to establish TCP/IP connection (connection 4) with the relay server 4 in the process (10'), and the terminal 21 transmits the user ID and the passwords to the relay server 4 in the process (11'). The relay server 4 carries out the certification of the terminal 21 by the received user ID and the password, and sends back the response in the process (12'). Then, to maintain the connection 4, the connection holding command is transmitted from the terminal 21 periodically to the relay server 4 in the process (13'), and the relay server 4 sends back the response to the terminal 21 in the process (14'). Further, if it is not necessary to maintain such vacant connection, the processes of (10) to (14), or (10') to (14') are not necessary. Moreover, in the case where a plurality of connections has already been secured, these procedures are not required to be carried out.

[0026] When it is confirmed of carrying out the communication

between the terminal 11 and the terminal 21 by the procedure of the processes (6) to (9), the terminal 11 transmits the data, which is to be sent to the terminal 21, to the relay server 4 by using the connection 1 in the process (15). The relay server 4 receives the data from the terminal 11, and transmits the received data to the terminal 21 by using the connection 2 in the process (16). The terminal 21 receives the data from the terminal 11 that was transmitted from the relay server 4 through the connection 2, and transmits the response directed to the terminal 11 to the relay server 4 in the process (17). The relay server 4 receives the response directed to the terminal 11 from the terminal 21, and transmits the received response to the terminal 11 through the connection 1 in the process (18).

[0027] In the manner stated above, by relaying the data by the relay server 4 using the connection 1 between the terminal 11 and the relay server 4, and the connection 2 between the terminal 21 and the relay server 4, the communication can be carried out between the terminal 11 and the terminal 21. Further, the data forwarding to the terminal 21 from the terminal 11 by the processes (15) to (18) may be repeated several times. Moreover, the data may be forwarded from the terminal 21 to the terminal 11.

[0028] When the data forwarding between the terminal 11 and the terminal 21 is completed, the termination notification is carried out from the terminal 11 or the terminal 21. It is to be supposed that the termination notification is carried out from the terminal 11, and the terminal 11 transmits the termination notification directed to the terminal 21 to the relay server 4 by using the connection 1 in the process (19).

The relay server 4 transmits the termination notification to the terminal 21, which was received from the terminal 11, to the terminal 21 by using the connection 2 in the process (20). Then, the terminal 11 which transmitted the termination notification transmits, the releasing notification indicating that the connection 1 has become vacant to the relay server 4 in the process (21). Moreover, the terminal 21 which received the termination notification also transmits, the releasing notification indicating that the connection 2 has become vacant to the relay server 4 in the process (21'). Accordingly, the relay server 4 memorizes that the connection 1 and the connection 2 are not to be used in the communication between the terminal 11 and the terminal 21 and that the connections have become vacant. Further, in this example, the response to the termination notification is not carried out, but it may be made to send back the response.

[0029] In the connection 1 and the connection 2 which were released in such a manner are maintained, the connection holding command and the response periodically as shown in the process (4), (5), or (4'), (5') are carried out, and the connection is maintained between the terminal 11 and the relay server 4, and between the terminal 21 and the relay server 4.

[0030] Further, at the time being, the connection 1 and the connection 3 are secured between the terminal 11 and the relay server 4. As in the same manner, the connection 2 and the connection 4 are secured between the terminal 21 and the relay server 4. This may be left in this state or the connection 1 and the connection 2 may be disconnected when releasing these connections. Of course, the connection 1 and the connection

2 may be continued land the connection 3 and the connection 4 may be disconnected.

[0031] When the terminal 11 shuts down the power source or stops the connection to the relay server 4, the terminal 11 notifies the log-out to the relay server 4 in the process (22). At the time being when a plurality of connections are secured, any connection may be used. Then, the terminal 11 disconnects a11 the connections to complete. In this example, the connection 1 is to be disconnected to complete in this process (23), and the connection 3 is to be disconnected to complete in the process (24). The relay server 4 receives the notification of the log-out from the terminal 11, recognizes the log-out of the terminal 11 and disconnects all the connections (connection 1, and connection 3) with the terminal 11. Further, the same applies to the terminal 21.

[0032] By carrying out the procedure described above, the communication can be carried out even in the case where each or either one of the devices is the network device in the local system. Meanwhile, the procedure for carrying out the connection with the relay server 4 as described above, the maintenance of the connection, the connection demand to the terminal, the data transmission to the terminal, the termination of the connection with the terminal, and the termination of the connection with the relay server 4 can be constituted so as to keep transparency and not to influence command or data to be exchanged by an application protocol working in the upper state, and the communication can be carried out by using the existing application protocol as it is.

[0033] Effect of the Invention] As it is clear from the

description above, according to the present invention, since a communication path is secured by connecting network devices in a local system to a relay server in advance and data is relayed by using the communication path, an effect is exerted that data forwarding from the Internet to the network devices in the local system or data forwarding between network devices in different local systems can be realized. Further, by performing certification at the time of connection, the safety of local system can be secured as well.

[Brief Description of the Drawings]

[Fig. 1] A block diagram showing a communication system including a relay server according to an embodiment of the present invention.

[Fig. 2] A sequence diagram showing an example of the communication procedure of the communication system including the relay server according to an embodiment of the present invention.

[Fig. 3] An explanatory view showing an example of a system using general Internet.

[Explanation of Reference Code]

1,2: Local system

3: Internet

4: Relay server

11, 12, 21, 22: Terminal

13, 22, 23: Gateway

14, 24: LAN

41: Communication unit

42: Connection information holding unit

description above, according to the present invention, since a communication path is secured by connecting network devices in a local system to a relay server in advance and data is relayed by using the communication path, an effect is exerted that data forwarding from the Internet to the network devices in the local system or data forwarding between network devices in different local systems can be realized. Further, by performing certification at the time of connection, the safety of local system can be secured as well.

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[Fig. 1] A block diagram showing a communication system including a relay server according to an embodiment of the present invention.

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[Fig. 3] An explanatory view showing an example of a system using general Internet.

[Explanation of Reference Code]

1,2: Local system

3: Internet

4: Relay server

11, 12, 21, 22: Terminal

13, 22, 23: Gateway

14, 24: LAN

41: Communication unit

42: Connection information holding unit

and relays data forwarding by using the TCP/IP connection established with a network device, which is specified in accordance with connection request information generated from said network device, and the TCP/IP connection established with said network device.

[Claim 2] A communication system in which a plurality of network devices and a relay server are connected by a network,

wherein each of said network devices establishes a TCP/IP connection to said relay server, and generates a connection demand with another network device to said relay server when communicating with another network device, and said relay server relays the communication between said network device and said another network device by using the TCP/IP connection with said network device and the TCP/IP connection with said another network device, which are established in advance with said another network device, in accordance with the connection demand from said network device.

[Claim 3] A communication system according to claim 2, wherein said network devices are devices to which connection from an outside network is limited.

[Claim 4] A communication system according to claim 2, wherein said network devices establish the TCP/IP connection with the relay server via a gateway device having an address converting function.

[Amendment 2]

[Name of Document to be Amended] Specification

[Name of Item to be Amended] 0008

[Amendment Method] Revision

[Contents of Amendment]

[0008]

[Means for Solving the Problems]

The present invention is a relay server having: communicating means capable of communicating with a plurality of network devices by severally using one or more TCP/IP connections; and connection information holding means for holding connection information of the network devices capable of communicating by the communicating means, in which the communicating means, after TCP/IP connection is established with the network devices, certifies the connection with the network devices in accordance with the connection information and maintains the TCP/IP connection, and relays data forwarding by using the TCP/IP connection established with a network device, which is specified in accordance with connection request information generated from the network device, and the TCP/IP connection established with the network device. In this manner, the relay server relays data forwarding between the network devices that are connected to the server. Accordingly, the data can be forwarded even in the case where the network device is a terminal within the local system, and the communication can be carried out from the Internet to the terminal within the local system, or between the terminals within different local systems. Moreover, by holding the connection information of the network devices capable of carrying out such relay communication, and by carrying out the communication with the network devices according to the connection information, the connection by the third party can be prevented and the safety of the local system can be maintained.

[Amendment 3]

[Name of Document to be Amended] Specification

[Name of Item to be Amended] 0009

[Amendment Method] Revision

[Contents of Amendment]

[0009]

Further, the present invention is a communication system where a plurality of network devices and a relay server are connected by a network, in which each of the network devices establishes a TCP/IP connection to the relay server, and generates a connection demand with another network device to the relay server when communicating with another network device, and the relay server relays the communication between the network device and the another network device by using the TCP/IP connection with the network device and the TCP/IP connection with the another network device, which are established in advance, in accordance with the connection demand from the network device. For example, even in the case where the network device is a device whose connection from the outer network is limited such as the terminal connected via a gateway device including an address converting function, since the data is relayed by the relay server that establishes the TCP/IP connection and communicably connected with these devices, the communication can be carried out between these devices.

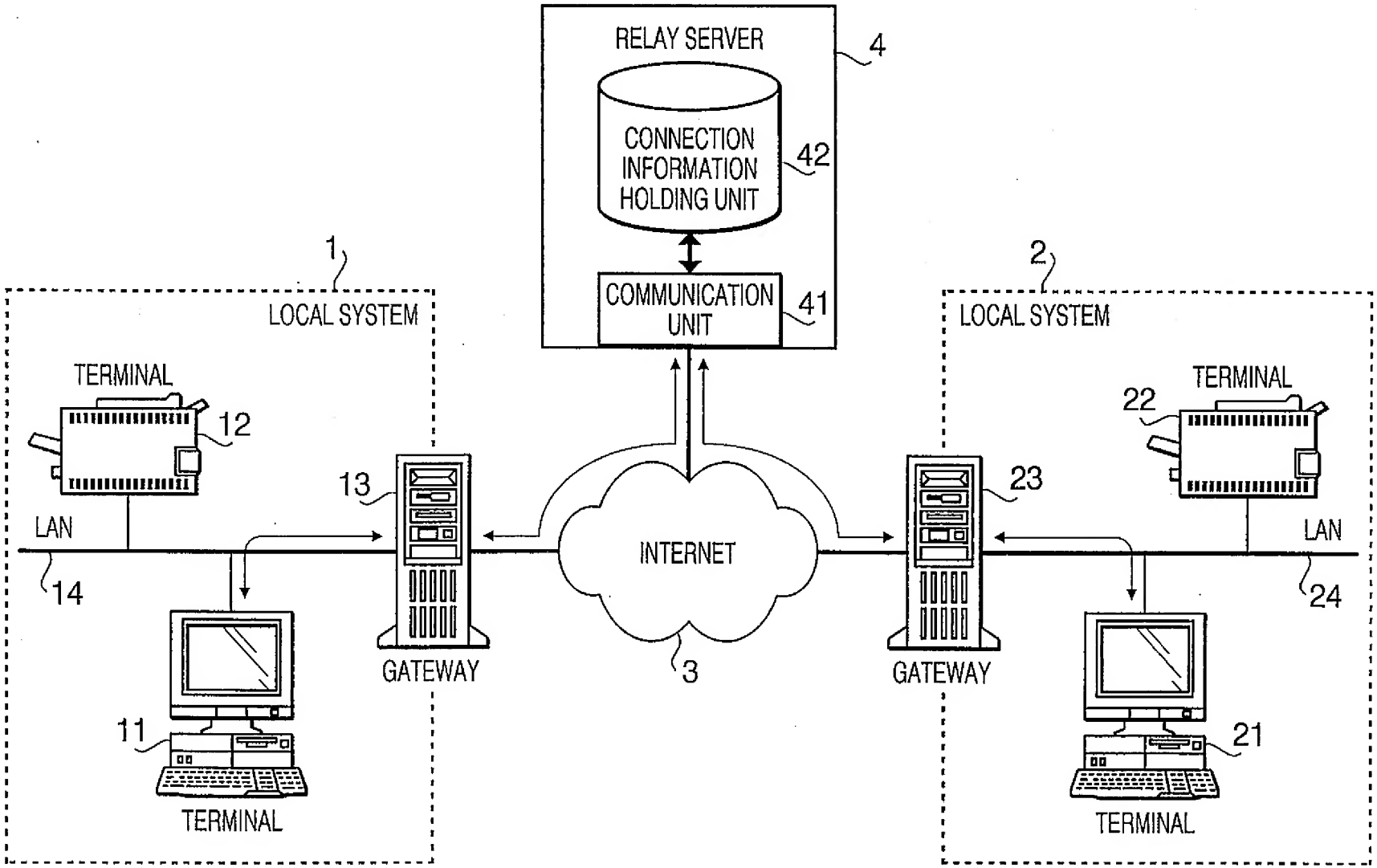
RELAY SERVER
4
CONNECTION INFORMATION HOLDING UNIT
42
COMMUNICATION UNIT
41
1
LOCAL SYSTEM
TERMINAL
12
13
LAN
14
GATEWAY
11
TERMINAL
INTERNET
3
2
LOCAL SYSTEM
TERMINAL
22
23
LAN
24
GATEWAY
21
TERMINAL

FIG. 1

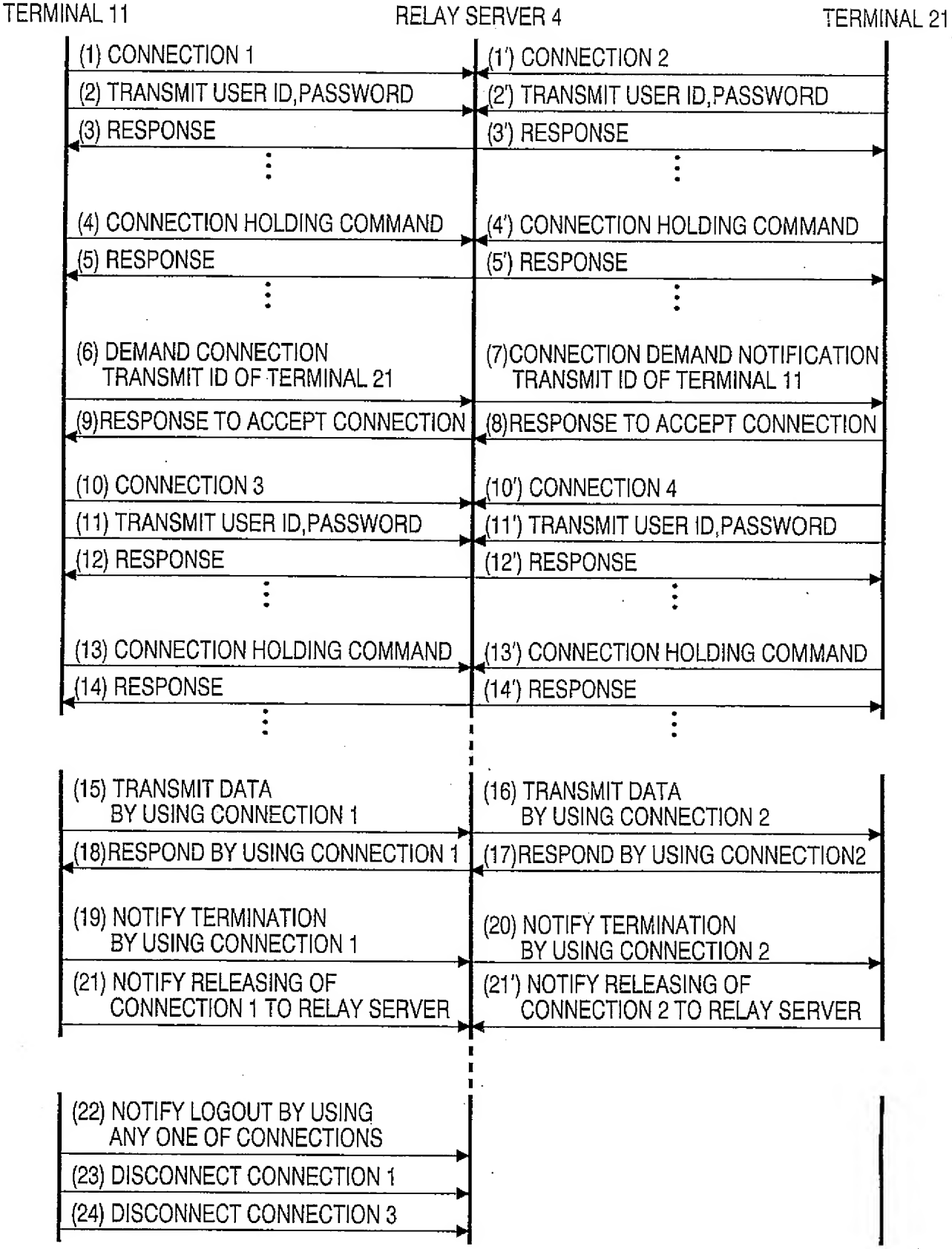
TERMINAL 11
RELAY SERVER 4
TERMINAL 21
(1) CONNECTION 1
(1') CONNECTION 2
(2) TRANSMIT USER ID,PASSWORD
(2') TRANSMIT USER ID,PASSWORD
(3) RESPONSE
(3') RESPONSE
(4) CONNECTION HOLDING COMMAND
(4') CONNECTION HOLDING COMMAND
(5) RESPONSE
(5') RESPONSE
(6) DEMAND CONNECTION TRANSMIT ID OF TERMINAL 21
(7)CONNECTION DEMAND NOTIFICATION TRANSMIT ID OF TERMINAL 11
(9)RESPONSE TO ACCEPT CONNECTION
(8)RESPONSE TO ACCEPT CONNECTION
(10) CONNECTION 3
(10') CONNECTION 4
(11) TRANSMIT USER ID,PASSWORD
(11') TRANSMIT USER ID,PASSWORD
(12) RESPONSE
(12') RESPONSE
(13) CONNECTION HOLDING COMMAND
(13') CONNECTION HOLDING COMMAND
(14) RESPONSE
(14') RESPONSE
(15) TRANSMIT DATA BY USING CONNECTION 1
(16) TRANSMIT DATA BY USING CONNECTION 2
(18)RESPOND BY USING CONNECTION 1
(17)RESPOND BY USING CONNECTION2
(19) NOTIFY TERMINATION BY USING CONNECTION 1
(20) NOTIFY TERMINATION BY USING CONNECTION 2
(21) NOTIFY RELEASING OF CONNECTION 1 TO RELAY SERVER
(21') NOTIFY RELEASING OF CONNECTION 2 TO RELAY SERVER
(22) NOTIFY LOGOUT BY USING ANY ONE OF CONNECTIONS
(23) DISCONNECT CONNECTION 1
(24) DISCONNECT CONNECTION 3

FIG. 2

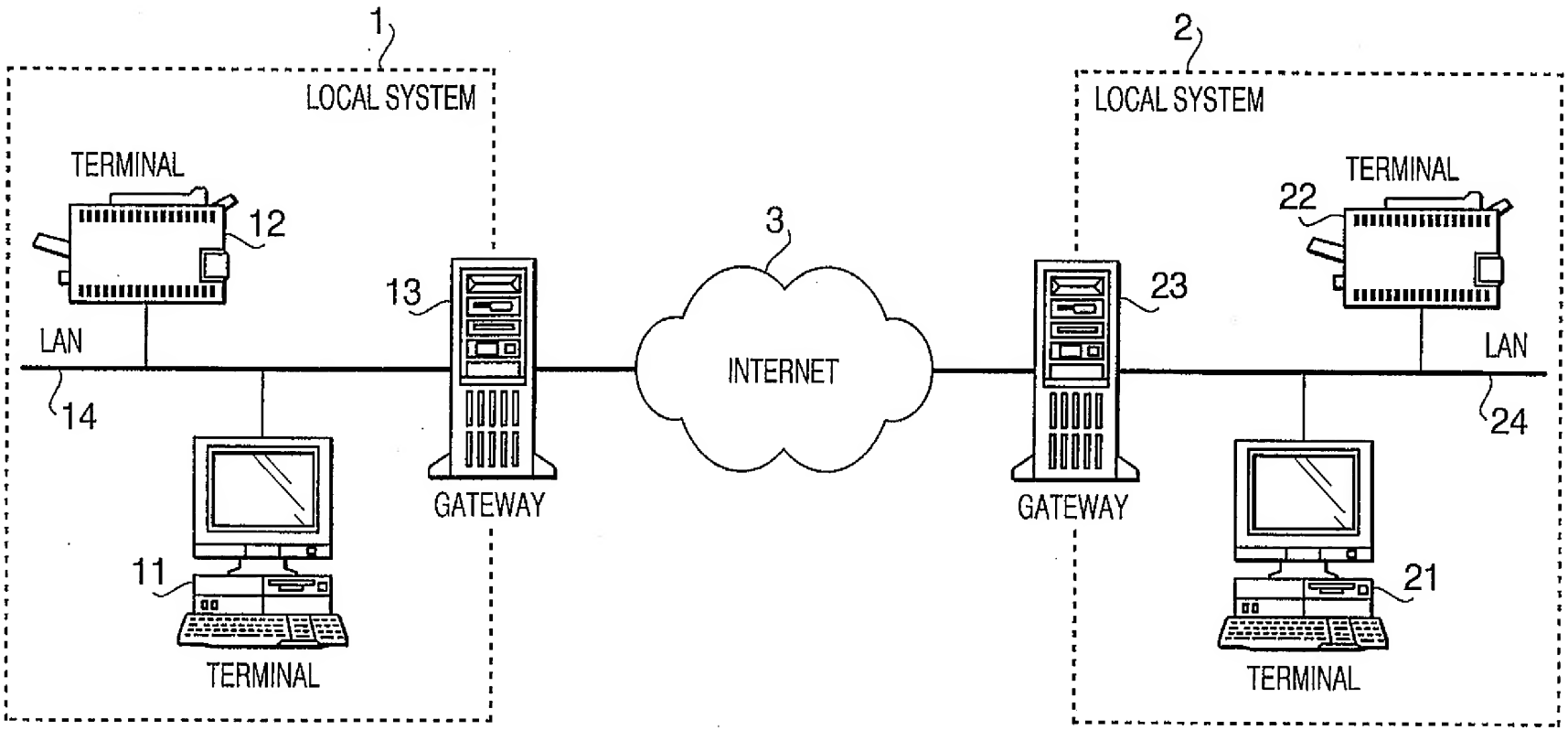
1
LOCAL SYSTEM
TERMINAL
12
LAN
14
13
GATEWAY
11
TERMINAL
3
INTERNET
2
LOCAL SYSTEM
TERMINAL
22
23
LAN
24
GATEWAY
21
TERMINAL

FIG. 3